

# PATENT SPECIFICATION

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## (54) CABLE CONNECTOR UNIT FOR ULTRASONIC INSTRUMENTS

- (71) We, KRAUTKRAMER GMBH, a German body corporate of 449 Luxemburger Strasse, 5 Cologne-Klettenberg, West Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—
- 10 The invention relates to an ultrasonic crystal probe unit and also to a combination of such a unit with a cable connector for connecting said unit to ultrasonic measuring or testing equipment.
- 15 Hitherto the ultrasonic equipment consists, in a manner which is already known, essentially of an oscilloscope with a corresponding voltage generator, an initial pulse transmitting unit to produce high frequency pulses, a control signal obtained from the sweep section, and an amplifier which amplifies small pulse voltages generated by received echoes. Essentially, the probe unit consists of a piezoelectric crystal plate (for example barium titanate), a metal or plastics material housing usually provided with a vibration-damping body, and corresponding connecting leads to the crystal plate.
- 30 Connecting the probe unit to the cable ends by means of a plug is already known. This has, however, its disadvantages as it leads to difficulties viz: in obtaining a watertight plug connection and further, over a longer period, in preventing corrosion and in maintaining a positive connection.
- 35 By another known method of equipping the probe unit with a solid cable connection, the disadvantage must be accepted that if the unit is or becomes defective, eg, due to wear, the head of the unit together with the cable must be exchanged. In such instances the entire measuring or testing installation must be taken out of operation as in some cases access to the cables is extremely difficult. Especially with automatic test installations the probe units are subject to a high rate of wear.

The aim of the invention is to avoid these afore-mentioned disadvantages and to provide a simple watertight and non-corrosive electrical connection between the ends of the cable and the crystals and which enables the units to be exchanged quickly without having to exchange the cables.

In accordance with the invention there is provided an ultrasonic crystal probe unit comprising a housing, a crystal probe located adjacent an end of the housing, an induction coil electrically connected across the crystal and located adjacent a second end of the housing, and means associated with said second end for detachably connecting the unit to a cable connector of an ultrasonic instrument.

In accordance with a further aspect of the invention, there is provided in combination with said unit a cable connector comprising a housing, an induction coil which is electrically connectable to an end of a cable insertable in the connector housing and is located adjacent an end of the connector housing, and means associated with said end of the connector housing and cooperable with said means associated with said second end of the unit such that the two coils are in mutually inductive relationship with each other. In this manner both the unit and the connector can be detached from each other very easily (which is a great advantage) by a simple mechanical action, or by merely pulling them apart without interfering with the electrical components. The manner in which the unit and connector are designed results in a highly corrosion-resistant and watertight assembly.

A further development of the invention enables each coil to be disposed in a cavity in its respective housing. The housings of the combination may be detachably connected together by means of a circular flange of each housing and cooperable fastening devices, however, the main connection between the housing is preferably in the form of cooperating clamps or plug and socket arrangements

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depending upon requirements (on an individual basis). Further, the housing of at least the unit or connector can be made from a flexible material which is sufficiently pliable so that there is a satisfactory seal between the unit and connector without having to use any auxiliary clamping means. Furthermore, one of the housings may be provided with a threaded female periphery into which a threaded male periphery of the other housing is screwable, one of said peripheries preferably being made from a flexible pliable material. Where circular flanges are provided, either one of the flanges can be supplied with tapped holes to accommodate suitable fastening devices, for example screws, bolts or similar devices. In individual cases, for example for larger probes or under difficult working conditions, a sealing ring can be inserted into a special groove provided in a mating surface of either the unit or connector.

One manner of construction of the invention is shown, by way of example, in the accompanying drawing which illustrates in partial cross-section a crystal probe unit detachably connected to a cable connector.

An electrical cable 10 connects an ultrasonic detector (not shown) to a cable connector 11 and a crystal unit 12. The corresponding housings 11a and 12a respectively, are positively clamped together at their mating faces. The end of the cable 10 is led through a drilled hole to or close to a cavity 13 in housing 11a and is electrically connected to an induction coil 14 by solder (or similar means). A second coil 15 is located in the housing 12a in a cavity 13a which is normally filled later, for example with synthetic resin. The front faces of the coils 14, 15 are located in the region of the plane of separation of the unit and connector. The electromagnetic coupling or the concentration of the magnetic field of the coils 14, 15 can be strengthened by adding auxiliary magnetic material in or to the coils, for example ferrite core 16 which is secured by clamp 16a to the respective part of the housing 12a. Pot cores could possibly be used for this purpose. The electrodes of a crystal probe 18 are connected to the second coil 15 with connecting wire 17. Unit 11 and connector 12 are clamped together (as per the drawing) using pin-type elements 19, 22 of a different material or which may be machined from or into one or either of the housings. Both housings are supplied with circular flanges 20 and 20a with tapped holes to receive a bolt 21 or a screw or similar fastening device. Two, three or more fastening devices may be provided on the flange face whereby the housings, by using a screw driver and the easily accessible screws, can be joined solidly together in a watertight

manner, and provide an electrical coupling without mechanical contact, yet which, on the other hand, may be easily separated if the crystal unit becomes either defective or worn. In individual cases a circular seal, for example an O-ring 23 made from either a plastics material or rubber may be used for sealing.

Coil 14 is tuned to the frequency of the ultrasonic instrument. The coil 14 and the cable 10 are encapsulated with epoxy resin to make them watertight. Coil 15 is similarly tuned to the test frequency and also encased in epoxy resin. The pulses coming from the ultrasonic instrument via cable 10 will thereby be transmitted to crystal 18 through the coil system 14 and 15.

#### WHAT WE CLAIM IS:—

1. An ultrasonic crystal probe unit comprising a housing, a crystal probe located adjacent an end of the housing, an induction coil electrically connected across the crystal and located adjacent a second end of the housing, and means associated with said second end for detachably connecting the unit to a cable connector of an ultrasonic instrument.
2. In combination with a unit as claimed in claim 1, a cable connector comprising a housing, an induction coil which is electrically connectable to an end of a cable insertable in the connector housing, and is located adjacent an end of the connector housing and means associated with said end of the connector housing and cooperable with said means associated with said second end of the unit such that the two coils are in mutually inductive relationship with each other.
3. A combination as claimed in claim 2, in which each coil is disposed in a cavity in its respective housing, each cavity being filled with a non-conductive material to locate each respective coil therein.
4. A combination as claimed in claim 2 or 3, wherein said detachable and cooperable connectable means comprise a threaded female periphery of one of said housings into which a threaded male periphery of the other housing is screwable.
5. A combination as claimed in claim 2 or 3, in which said detachable and cooperable connecting means comprise clamps or plug and socket arrangements.
6. A combination as claimed in any one of claims 2, 3 and 5 in which each of the housings has a circular flange provided with a number of cooperable fastening devices.
7. A combination as claimed in any one of claims 2 to 6, in which mating surfaces of the housings have on the outer circumference, a circular sealing ring made from a pliable material, located in at least one groove.
8. A combination as claimed in claim 4, in which at least one of the threaded male and

female peripheries is made from a flexible pliable material.

9. An ultrasonic crystal probe unit substantially as herein described with reference to and as shown in the accompanying drawing.

10. A combination of an ultrasonic crystal probe unit and a cable connector substantially as hereinbefore described with reference to and as shown in the accompanying drawing.

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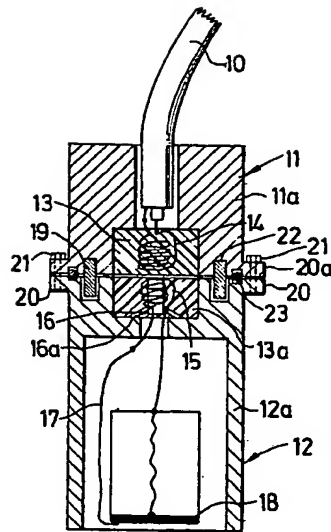
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COMPLETE SPECIFICATION

1 SHEET

*This drawing is a reproduction of  
the Original on a reduced scale*



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